HY-G-300®

Bendix **6877**
Type TE-48

RELIABLE HARD GLASS MINIATURE LOW MU TRIODE



DESCRIPTION

One of the Bendix Red Bank line of HY-G-300 tubes, this miniature reliable hard glass, low Mu triode has been designed for use in voltage regulator circuits in aircraft, military and industrial applications where freedom from early failures, long average service life, uniform operating characteristics and minimum space requirements are extremely important. Each tube is given a 45 hour run-in under overload, vibration and shock conditions likely to be encountered in service. This run-in serves to reduce early failures by eliminating tubes with any minor defects that might lead to failure under operating conditions.

Since this tube is designed for use in equipment with high ambient temperatures and where high levels of vibration and shock are encountered, special materials and techniques are employed. The hard glass bulb and tungsten stem seal construction are features similar to those found on many high-powered transmitting tubes. Careful exhaust to a high degree of vacuum, with thorough outgassing of all elements by means of electron bombardment, as well as the usual RF induction heating, insures maximum life expectancy. These factors, as well as a conservative design center of cathode temperature, permit operation of the 6877 at bulb temperatures up to 300°C. Moreover, because of the lower expansion (about 1/3 that of conventional receiving tube "soft glass"), greater resistance to thermal shock is attained.

This tube is constructed with ceramic spacers rather than the usual mica. Therefore, one of the most prevalent causes of tube failure is eliminated, namely, gas evolution under vibration (from deteriorated mica) and subsequent loss of cathode emission. In addition, ceramic spacers contribute to a much sturdier structure, which is further strengthened by multi-pillar supports locked together with welded eyelets. Bulb snubbers are made with an alloy which retains its spring properties at the high temperatures under which this tube can operate.

The heavy-gauge heater construction, together with a pure alumina insulator, permits operation at high heater-cathode voltages. The large area cathode operating at moderate temperatures gives long service life. Small mass of the tube elements, multi-pillar mount locked together with eyelets, and increased electrode spacing provide rigidity, strength, and increased ability of the tube to withstand shock and vibration.

See the enlarged view on last page for the many improved features of this tube.

CHART 1. ELECTRICAL RATINGS*

Heater Voltage (AC or DC)**	6.3 volts
Heater Current	0.8 amp.
Plate Voltage (Maximum DC)	200 volts
Peak Plate Voltage (Max instantaneous)	400 volts
Plate Dissipation (Absolute Max)	12.0 watts
Cathode Current (Max DC Value)	100 mA
Cathode Current (Max Inst. Peak Value of continuous sine wave)	200 mA
Cathode Current (Max Inst. Peak Value) Pulse***	750 mA
Heater-Cathode Voltage (Max)	±450 volts
Grid Resistance (Max)	
Cathode Bias	1.0 Meg
Fixed Bias	0.1 Meg
Any combination of fixed and cathode bias	0.1 Meg
Grid Voltage (Max DC)****	+5.0 volts
(Min DC)	—150 volts
Cathode Warm-up time	45 seconds

(plate and heater voltage may be applied simultaneously)

*To obtain greatest life expectancy from tube, avoid designs where the tube is subject to all maximum ratings simultaneously. See application notes.

**Voltage should not fluctuate more than ±5%.

***Short duration pulses only.

****Limit grid current to 5 mA max.

CHART 2. MECHANICAL DATA

Base	9-Pin Miniature Nonex Glass—Gold Plated Pins
Bulb	Nonex Glass—T6½
Max Overall Length	3″
Max Seated Height	2¾″
Max Diameter	⅞″
Mounting Position	any
Max Altitude	80,000 feet
Max Bulb Temperature	300°C
Max Impact Shock	500G
Max Vibrational Acceleration	50G
(100 hour shock excited fatigue test, sample basis)	
Life Expectancy	10,000 hrs.

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ELECTRICAL CHARACTERISTICS AND TEST DATA

CHART 3.

TEST CONDITIONS AND CHARACTERISTIC LIMITS

All Tubes are Stabilized for 45 Hours Under Test Conditions and 2 G Vibration at 30 Cps Prior to 100% Testing.

CHARACTERISTIC		SYMBOL	MIN	DESIGN CENTER	MAX	UNITS
PRODUCTION TESTS:						
Short and Continuity						
Heater Current		If	0.74	0.80	0.86	A
Heater Cathode Leakage (Ehk = ± 450 Vdc)		Ihk	—	—	25	μAdc
Grid Current		Ic1	—	—	—1.0	μAdc
Plate Current		Ib	60	75	90	mAdc
Transconductance (1)		Sm	5500	6500	7500	μmhos
Cut off Plate Current (Ecl = — 100 Vdc)		Ib			2.0	mAdc
DESIGN TESTS						
Transconductance (2) (Ef = 5.7 V)		△ Sm			10%	
Grid Emission (Ef = 7.5 V)		Ic1	—	—	—5.0	μAdc
ELECTRODE:	Ef	Eb		Ec1		Ehk
TEST CONDITIONS:	6.3 volts	100 Vdc		—12 Vdc		0 Vdc

CHART 4.

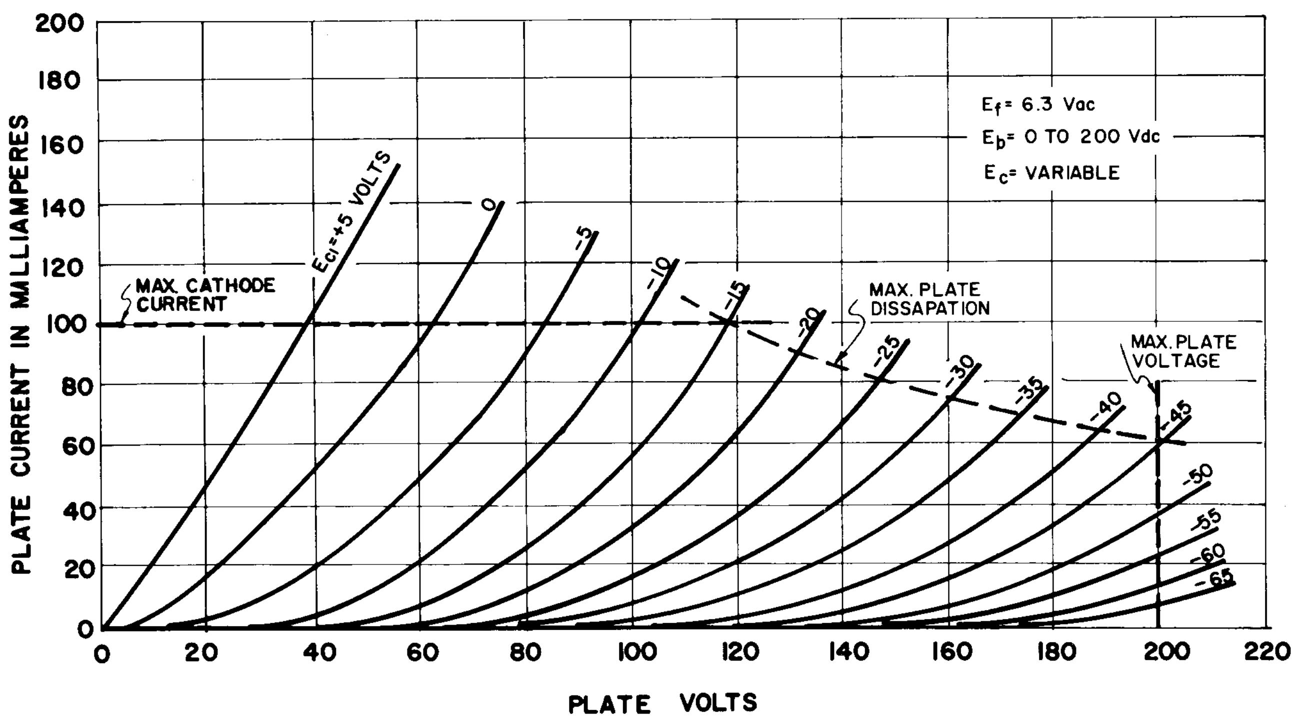
ADDITIONAL TESTS

In addition to the production and design tests shown in Chart 3 other tests are performed on a sampling basis to assure a high outgoing quality level. See below.

TEST	CONDITIONS	DURATION
Heater Cycling Life Test	On 1 Min Off 4 Min Ef = 7.5V Ehk = 300 Vac	2,000 On-Off Cycles
High Temp Life Test	Under "Test Conditions" at 12W Plate Dis. Bulb Temp. 300°C	1,000 Hours
Life "Expectancy" Test	Under "Test Conditions"	10,000 Hours
High Level Fatigue Test	50G—Shock Excitation 15 Cycles/Sec.	100 Hours
Shock	500 G	20 Impacts
Altitude Test	80,000 Feet	5 Minutes
Glass Strain Test	Boiling Water to Ice Water	3 Minutes in Each
Mount Inspection	100% Test-Microscopic Inspection of 30 Possible Trouble Points	
Swept Freq Fatigue	2.5G—F = 50—500—50 CPS in two minutes	32 Hours in each of three planes

CHART 5.

AVERAGE PLATE CHARACTERISTICS



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APPLICATION NOTES

Special attention should be given to the temperatures at which the tubes are to be operated. Reliability will be seriously impaired if maximum bulb temperature is exceeded. The life expectancy will be reduced if conditions other than those specified for life test are imposed on the tube and will be reduced appreciably if absolute maximum ratings are exceeded. Both reliability and performance will be jeopardized if filament voltage ratings are exceeded. Life and reliability of performance are directly related to the degree that regulation of the heater voltage is maintained at its center rated value.

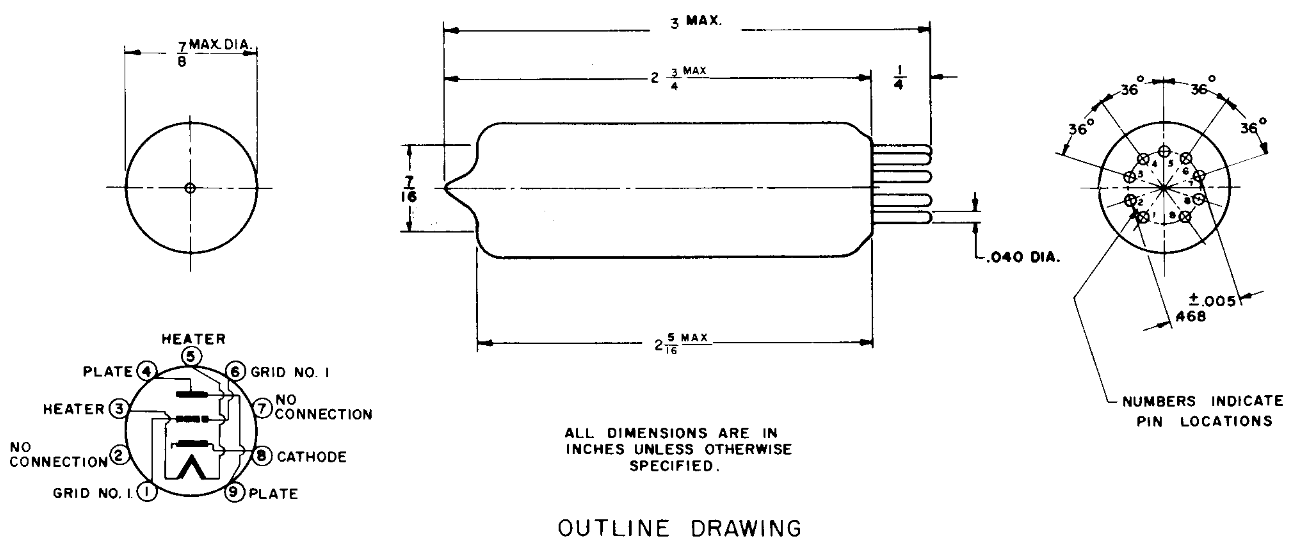
This tube is constructed using nonex glass and thus can withstand higher ambient temperatures in operation. However, the bulb temperature should never exceed 300°C at its hottest point and cooling should be employed if necessitated by the additive effects of operation at high altitudes and high dissipation simultaneously or by other sources of heat in the equipment or dissipation derating must be applied. The dissipation derating must be measured for each application because of the additive effects mentioned above.

Each proposed application should be life tested under maximum environmental conditions in order to check that the design gives the desired reliability. When conservatively used this tube has a life expectancy of 10,000 hours.

CHART 6.

EFFECT ON LIFE OF INCREASED RATINGS

See also Application Notes	OPERATING CONDITIONS		
RATING OR CHARACTERISTIC	CONSERVATIVE	TYPICAL	MAXIMUM
Heater Voltage	6.3 ± 2%	6.3 V ± 5%	6.3 V ± 10%
Plate Voltage	100 Vdc	150 Vdc	200 Vdc
Peak Plate Voltage	200 V	300 V	400 V
Plate Current (Av.)	50 mA	75 mA	100 mA
Cathode Current (Peak)	100 mA	150 mA	200 mA
H-K Voltage	200 V	300 V	450 V
Grid Resistance (Fixed Bias)	50,000 ohms	75,000 ohms	100,000 ohms
Bulb Temperature	200°C	250°C	300°C
Vibration	2 G	5 G	10 G
LIFE EXPECTANCY	MAXIMUM	HIGH	MEDIUM

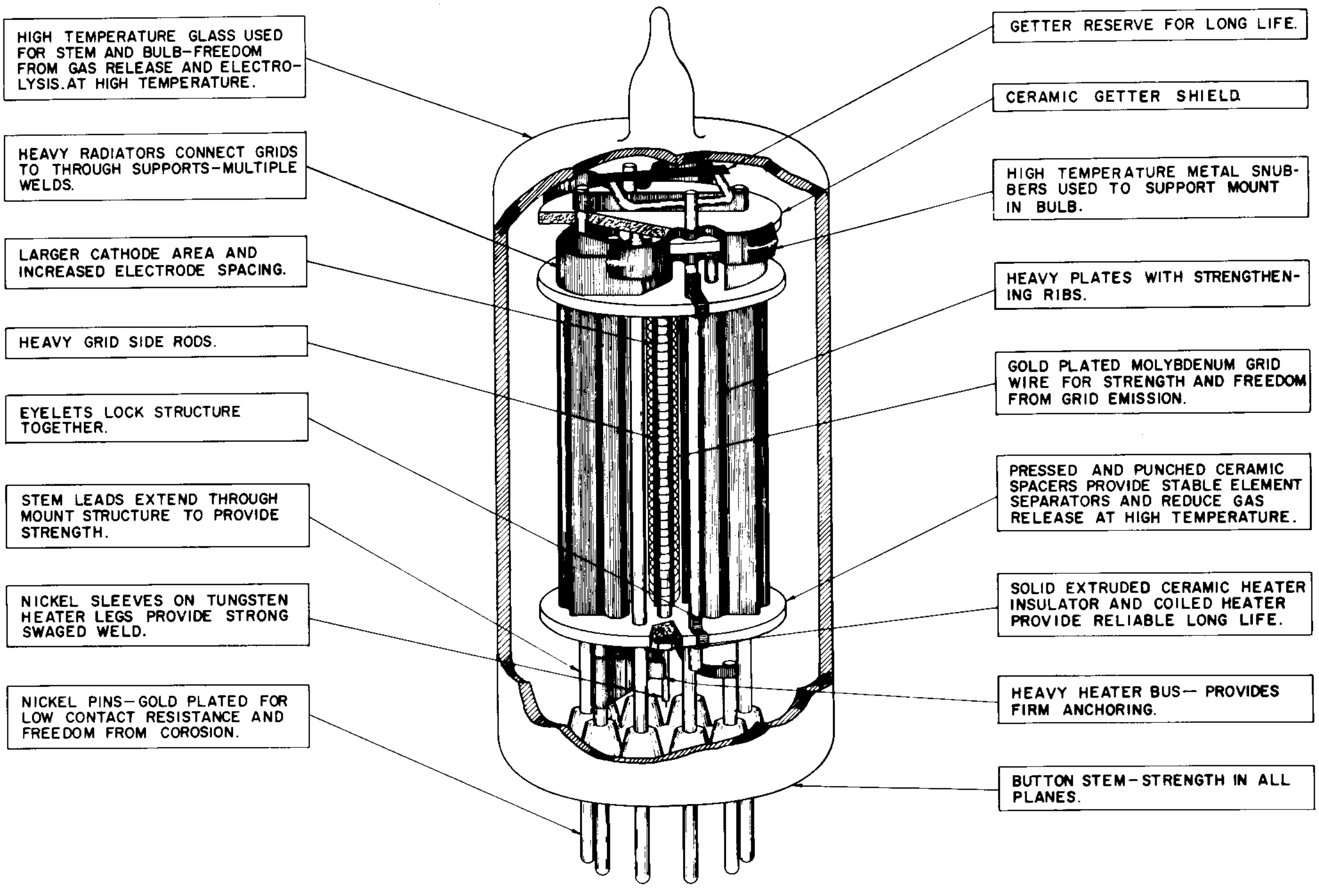


OUTLINE DRAWING

MINIATURE LOW MU TRIODE

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STRUCTURAL FEATURES OF 6877 PROVIDE HIGH RELIABILITY AND LONG LIFE

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